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Chicago 54, Ill. * February 1944

OTTER TRAWL NET FOR SMALL FISHING BOATS[1/]

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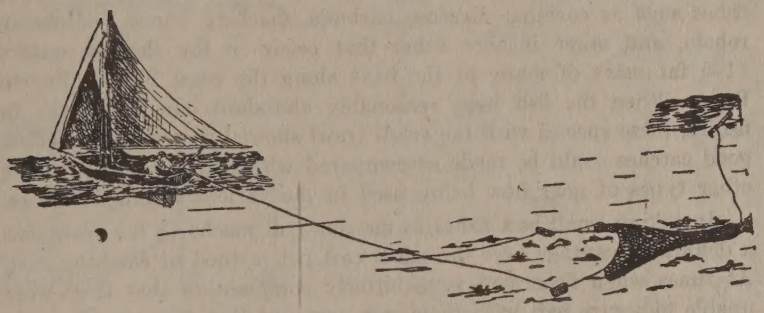

"Otter trawl" is the name of that type of bottom net which is fished by towing it behind a boat as shown in the above sketch. The mouth of the net is held open by the action of two doors which, when drawn through the water, have a reaction similar to that of a kite in the air. Large otter trawls operated from steam or Diesel powered boats have for many years been one of the primary gears used for taking enormous quantities of bottom fish on the New England Banks, North Sea and in other parts of the world. These large trawls are intricate in design and the product of many years of experimentation and constant improvement. The vessels using them have special winches and other deck equipment specifically designed for trawl operation. Bearing in mind that the regular fishing boat used in the Puerto Rican fisheries is neither large enough nor sufficiently equipped to make use of a large commercial trawl, experiments have been carried out during the past year in designing and adapting a small otter trawl to the sailboats and launches which are common to the fisheries of Puerto Rico.

A "box net" made of cotton webbing is probably one of the simplest types of otter trawls to construct and at the same time utilizes most of the fishing principals of the larger and more complicated trawls. Several of the following pages are devoted to the details of the construction of a box net trawl and otter doors suitable for use with a small sailboat or ordinary launch. Before going into the construction details of this apparatus, however, it would be ad-

1/From Fishery Bulletin of Puerto Rico, vol. 9, No. 2, June 1943.

visable to briefly point out the advantages as well as the limitations of a device of this kind when used in waters along the Coast of Puerto Rico. In making an appraisal of its commercial value these are points that would be raised by any fisherman who is totally unfamiliar with this type of gear.

Uses of Trawl Net

As to advantages, this trawl is capable of taking small market fishes such as corbina, dienton, barbuda, machete, ronco, corcobado, robalo, and other inshore fishes that occur in the shallow waters (1–5 fathoms) of many of the bays along the coast line of Puerto Rico. When the fish were reasonably abundant our experience in fishing these species with the small trawl showed that with less effort good catches could be made as compared with catches of any of the other types of gear now being used in the various fishing localities.

In taking small bait fishes as manjua and machuelo the trawl has a definite advantage over the usual cast net method of catching bait. At times when fishermen were bitterly complaining that they were unable to secure bait with their cast nets and therefore unable to do fishing with their handlines, the trawl when set out produced more than sufficient bait for their needs. This is an important point inasmuch as handlining is one of the chief methods of fishing in Puerto Rico, and without bait a handliner cannot work. Usually, when the trawl is hauled aboard the boat it contains a great variety of sizes and species of fish and after the larger marketable fish are sorted out there remains a quantity of smaller fishes suitable not only for handline bait, but also for nasa bait. Every hour saved by a fisherman in searching for bait means an extra hour of fishing; a matter of considerable significance during present wartime conditions when the hours of fishing are severely restricted.

The trawl can also be used in combination with other gears presently fished by Puerto Rican fisherman, for example, the beach seine. The beach seine requires about eight men for operation and frequently is set out and hauled back only with hopes of making a good catch. Such a procedure often results in "water hauls" and a great amount of lost effort which partially could be eliminated by making a trial drag with a trawl over the seine grounds prior to setting out the seine. If results of the trial drag indicated that bottom fish are abundant enough to warrant setting the haul seine, then the seine could be set with more positive assurance that fish would be caught. A trawl also has access to fish that sometimes occur

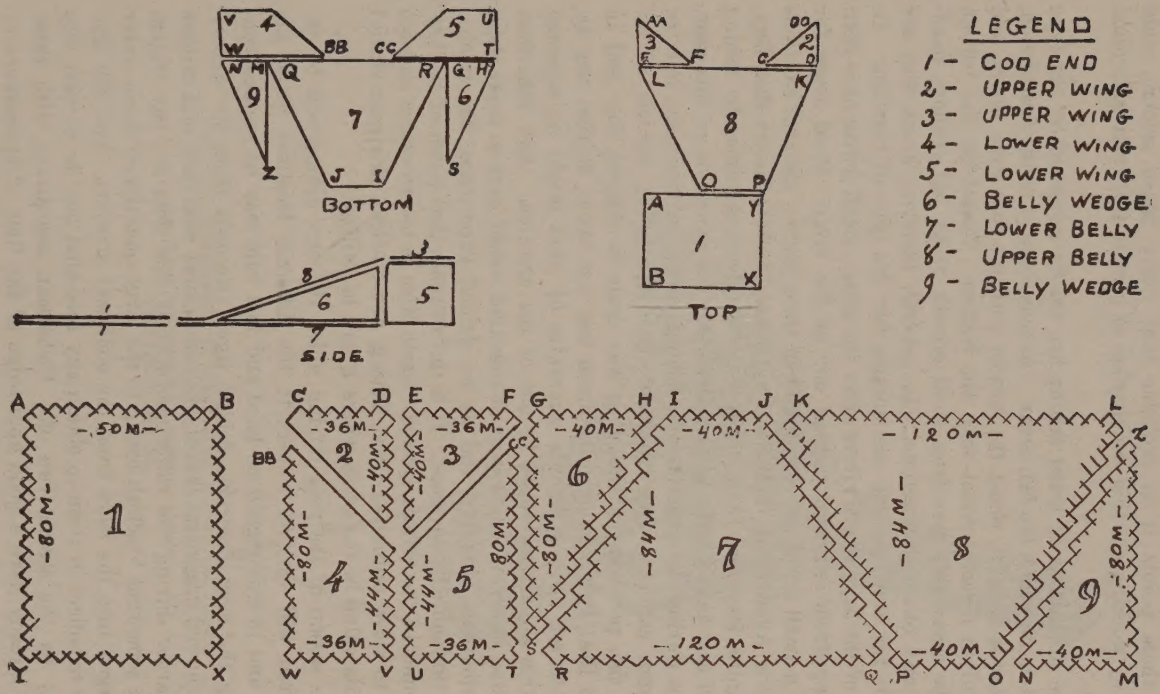

FIG. I.—(Above) Shows how sections of trawl can be cut from one piece of webbing No. 9 or No. 12 seine twine, 2" stretch mesh. Cod end No. 30 seine twine, 2" stretch mesh.

FIG. II.—(Below) Shows method of joining sections shown in Figure I into upper, lower, and side parts of trawl.

off-shore just beyond the workable radius of the beach seine. Considering these points it is probable that many beach seiners could profit by working out this combination of gear to suit their individual needs.

The limitations of trawl fishing are chiefly governed by the type of bottom on which the fish occur. As may be seen in the first sketch, this gear is dragged along the bottom with the foot rope, doors, and cod end in direct contact with the bottom. Therefore, the bottom must be reasonably free from coral growth, rocks, old anchors, deadheads and other obstructions. In general, however, areas that are suitable for beach seining are suitable for this type of trawling. In many of the bays where rivers enter the ocean, small deltas have been built up from sediment carried out by the river. Good areas for use of a small trawl are also found in these parts. Several locations including Añasco Bay, Tallaboa Bay, Jobos Harbor, Puerto Real Bay, Guayanilla Bay, and Loíza River Bay have been examined by fishing a trawl and have proven to be satisfactory for operation of this gear. Catches during the experimental fishing varied considerably, but the maximum catch of approximately ninety-five (95) pounds of assorted fish per hour of dragging was made in Añasco Bay and in Puerto Real Bay. Frequently much less was taken, so that any attempt to set forth a definite guarantee of what might be expected from this apparatus would be out of the question. Any fisherman interested in trying a new gear of this kind would have to make those determinations himself; and as he gained experience, his catches would undoubtedly increase. It is unfortunate that much of the bottom found in the waters around Puerto Rico is too irregular and too rough to allow unlimited trawl fishing, nevertheless, this gear should prove its value in the areas where it can be utilized.

The season of the year during which the best fishing will be encountered will vary in respect to the different localities along the Coast, and in this regard no hard and fast rule may be applied concerning the most favorable fishing time. Records from our experiments showed in general that the fish were more abundant and catches were larger during the rainy season. At this time the bay waters become somewhat brackish owing to the large quantity of fresh water discharged into the bays from the confluent streams. The fish also appear to collect in them to obtain any food that may be carried into the bay by the stream run off. Fisherman acquainted with these waters already have a good knowledge of the time of appearance of the various species of fish, and therefore, little emphasis need be given to this point.

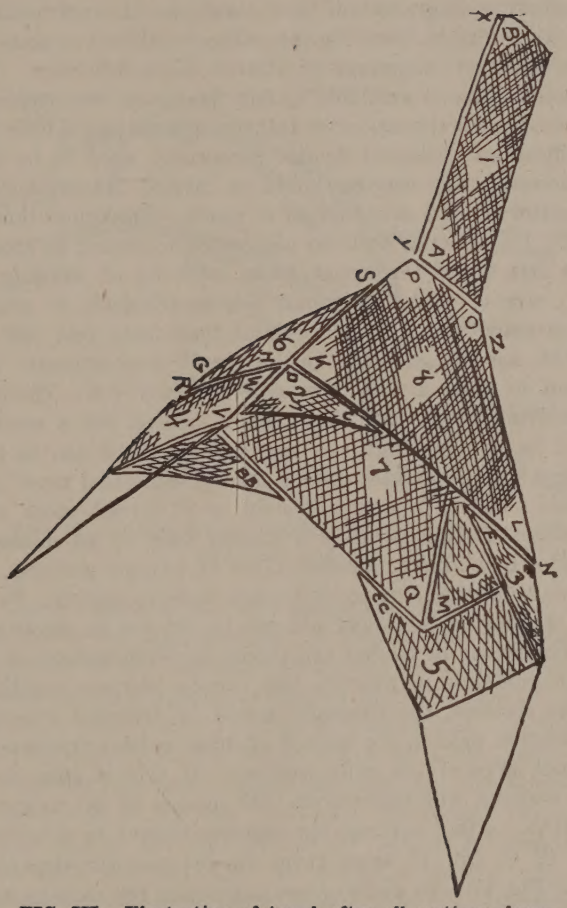

FIG. III.—Illustration of trawl after all sections shown in Fig. II have been joined. Letters and numbers correspond to sections shown in Figs. I and II.

Construction of the Net

The following diagrams will be of assistance in constructing a box trawl net which can be towed by the ordinary sailboat or small launch commonly operated at present by Puerto Rican fishermen. Its simplicity should make it available to any fisherman who has access to a small amount of webbing, a few fathoms of rope and a little lumber. The specifications indicated do not necessarily need to be followed exactly, however, any change should be carried out proportionately over the entire net, if a net of larger or smaller dimensions than shown is desired. The trawl as outlined will have an opening of about fourteen (14) feet across the mouth when made up of webbing of two inch (2″) stretch mesh. It would not be advisable to attempt to construct a trawl with a mouth greater than forty feet (40′) based on this box net design since such a great proportionate increase would tend to make a very clumsy and heavy net. Therefore, it should be remembered that this type is offered for a small trawl because of its simple design and ease with which it can be built by a person not well acquainted with a more complicated trawl net.

To build a net of this type a strip of 2″ stretch mesh webbing, No. 9 or No. 12 seine twine, 275 meshes long by 84 meshes wide, is required. In addition, another piece of heavier webbing, No. 30 seine twine, 50 meshes long by 80 meshes wide, is needed. From this material, sections of the trawl net can be cut out as shown in Fig. I. The dimensions in meshes are shown for each section as well as letters for guidance in putting the various sections together. In cutting the sections, the diagram should be followed exactly with special attention paid to the method of offset cutting indicated along the diagonal sides of the belly sections. If this is done correctly, the belly sections will taper from 120 meshes to 40 meshes in 84 meshes depth. After cutting, the sections should be bent together with No. 12 or No. 15 seine twine in the manner shown in the diagram in Fig. II. To avoid errors in bending the sections together, it is well to start at a definite point and to end at a definite point in making up the body of the net. The bottom section as shown in Fig. II should be put together first by connecting the belly wedges (9) and (6) to each side of the lower belly (7) along edges MZ and GS starting at Q and R. Since the sides of the belly wedges MZ and GS are a few meshes shorter than the sides of the belly, it is important to start bending at Q and follow directly along the edge of the belly wedges so that all meshes will meet informly as far as the belly wedge reaches. Then starting at W, the lower wing (4)

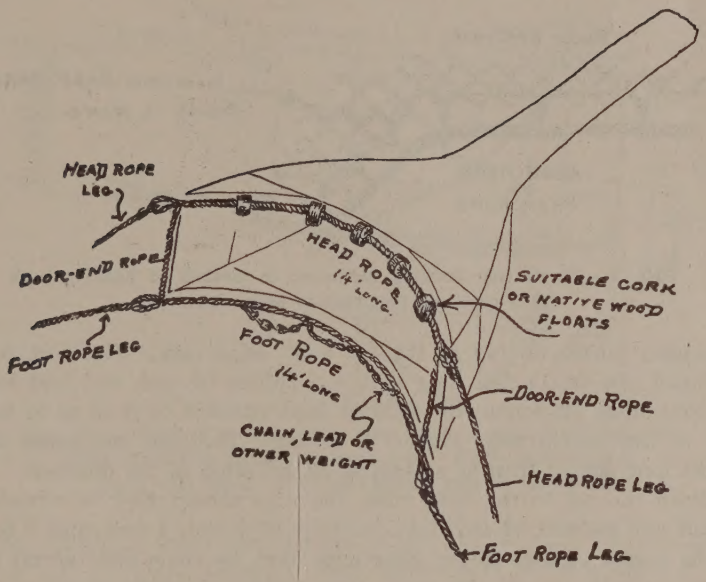

FIG. IV.—Illustration of position of head rope, foot rope, door ends, and legs.

is bent, mesh to mesh, to the belly wedge and belly. Lower wing (5) is connected in the same manner. Following this; the top section is put together by bending upper wings (3) and (2) to top belly (8) as indicated in the diagram starting at points E and D. Next, the top section is placed over the bottom section and the two sections connected together to form a funnel shape by bending edge VWNZJ to edge AAELO and then bending the corresponding edges together on the other side of the net. Cod end (1) is now to be attached to the after end of the belly section OP and JI by mending, mesh for mesh, along the side AY. To complete the cod end after attaching it to the belly, side AB is bent to side YX. If these instructions are followed the net as this point should resemble the illustration shown in Fig. III.

To complete the trawl net it is now necessary to make up the head rope, foot rope and door ends as shown in Fig. IV. All can be of either 9 or 12 thread rope. Eye splices should be made in each end of a 14 foot length of this rope to serve as a head rope upon which five floats of cork or native yagrumo wood are distributed as shown in Fig. IV. These floats each should have a buoyancy

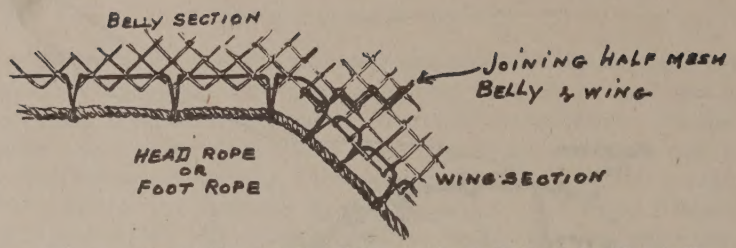

FIG. V.—Illustration showing difference in method of bending both head rope and foot rope to belly and wing.

roughly corresponding to that of a 3″ seine cork. The foot rope should also be 14 feet long with eye splices in each end and have about 10 or 12 pounds of chain or lead attached to it so as to hold it on the bottom when the net is fishing. The door end ropes, 2½ feet long should then be spliced in as indicated in the diagram. To attach the net to the head rope, the rope should first be stretched taut and marked off into three sections of 5 feet, 4 feet, and 5 feet. The corner of each upper wing must then be made fast behind the eye on each end of the rope. The middle or center mesh of the belly is then fastened to the middle of the rope and from this point the edge of the belly is bent outward on the rope in both directions by the half mesh (Fig. V) so that the entire edge of the belly is ultimately attached to the 4 foot center section of the head rope. Each wing then is connected to the corresponding five foot section of the head rope by bending it along the bar of the mesh of the wing as shown in Fig. V.

The net wings are bent to the door end ropes by the half mesh. This completes the construction of the net itself, however, to fish it a pair of otter doors is needed.

Otter Door Construction

The otter doors are the apparatus that hold the mouth of the trawl open when fishing. They are attached to the tow lines in such a manner that when they are dragged along the bottom the resistance of the water causes them to "spread" or pull away from each other, thereby opening the mouth of the net. The general idea can be obtained from observing Fig. VIII. Details of the construction of the otter doors are illustrated in Fig. VI and Fig. VII. In figure VI there is shown the straight door or the simpler type to build. Fig. VII shows the details of a "streamline" door developed in our pro-

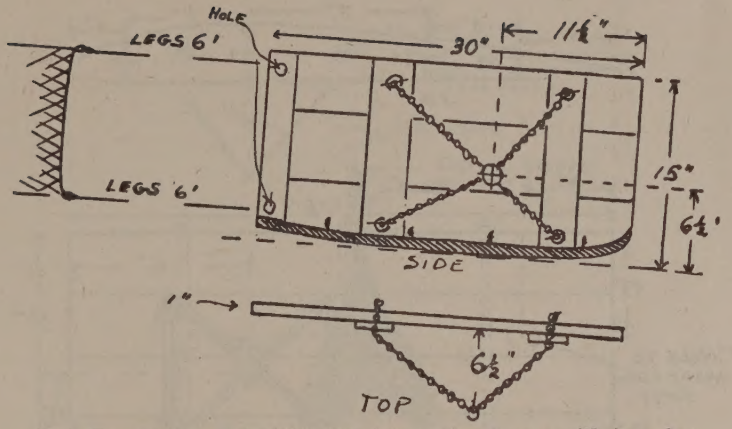

FIG. VI.—Design of straight otter door made of wood with iron shoe. Door illustrated is the left hand door. Right hand door is made with chain bridle on opposite side of the door.

gram which is more efficient and much smaller than the straight door and therefore, easier to tow; however, it is more difficult to construct. Either type of door will give satisfactory results; so that the type selected most probably will be governed by the materials available to the individual fisherman as well as the tools at hand. Great care should be given in building the doors according to the specifications shown, as well as remembering that both a *right* hand door and a *left* hand door is needed. The straight door can be made of 1″ lumber with a smooth flat iron shoe fastened to the bottom. The thickness of the iron shoe should be gauged to give the entire door a weight about of 20 pounds when finished. The ''streamline'' door can be cut out of 2″ × 2″ lumber and bolted together as shown in Fig. VII. Again the iron shoe on this door should be sufficiently thick to give the door a total weight of 20 pounds. In making the iron brackets or chain bridles, the center to which the tow lines are attached should be exactly in the position shown in the diagrams, otherwise the doors will not ''ride'' correctly when fishing. Adjustments in the length of the chain bridle can be made by inserting a pin through a link of the chain on the back side of the door.

In the event that a larger or smaller trawl net than shown here is made up, the doors must also be altered in the same general proportions. Nevertheless, in making any alterations, the individual fisherman probably would have to make several trial adjustments to suit the doors to his purpose.

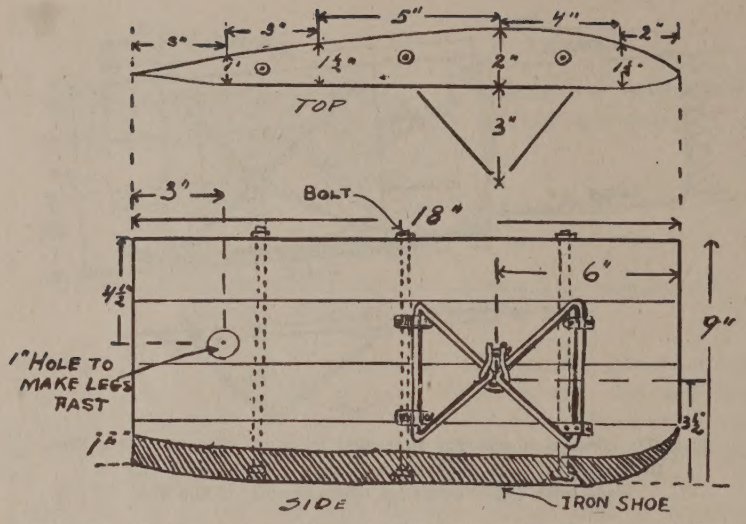

FIG. VII.—Design of "stream line" otter door made of wood with iron shoe. This door is more efficient than straight door shown in Fig. VI, but also requires greater precision in construction.

How to Set Out and Haul Back the Net

When the trawl net, doors, tow lines, and buoy line have been rigged up as shown in Fig. VIII, the entire outfit is ready for service. The cod end must now be closed by a turn of the buoy line after which the net should be piled on the stern of the boat with the doors and all lines clear so that they may be paid out while the boat is under way. While the boat is on a straight course and slowly under way the buoy and buoy line should be paid out over the stern, then the cod end, belly and foot and head ropes put over in that order. At this stage the legs are checked up until the foot rope sinks and floats of the head rope are on the surface of the water to assure that all of the net is opened and clear. Then slack is given slowly enough to maintain tension on the net, and the doors dropped over the stern simultaneously. The bridle is checked up until the forward speed of the boat causes the doors to "spread open". When it is seen that the doors are spreading properly and beginning to sink, then the tow line is paid out slowly until sufficient line is out to allow the trawl to fish in the bottom. The tow line then should be made fast to a bit or cleat and the boat given full headway to drag the net over the bottom.

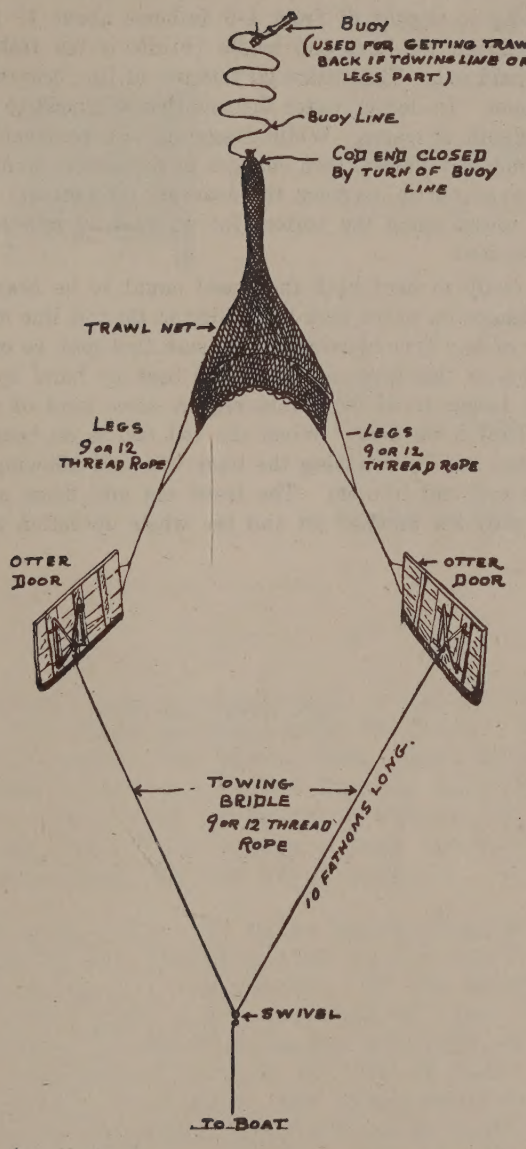
BUOY
(USED FOR GETTING TRAWL BACK IF TOWING LINE OR LEGS PART)
BUOY LINE
COD END CLOSED BY TURN OF BUOY LINE
TRAWL NET
LEGS 9 OR 12 THREAD ROPE
LEGS 9 OR 12 THREAD ROPE
OTTER DOOR
OTTER DOOR
TOWING BRIDLE 9 OR 12 THREAD ROPE
10 FATHOMS LONG
SWIVEL
TO BOAT

FIG. VIII.—Diagram showing complete otter trawl net, doors, bridle, and buoy in position for fishing.

In fishing in depths of from 1–5 fathoms about 10 fathoms of tow line between the boat and bridle (bridle is ten fathoms long) should be paid out. This makes 20 fathoms of line between the boat and the doors. In deeper water the tow line will need to be about 3 times the depth of water. While dragging, if a reasonably straight course cannot be followed, then changes in the course should be made gradually so as not to overturn the doors on the bottom. The trawl should be towed along the bottom for at least 20 minutes or even longer if desired.

When ready to haul back the vessel ought to be heaved to and the trawl hauled on to the deck by pulling in the tow line manually or by the use of any type of winch or capstan that may be on the boat. Small trawls of this type can be hauled back by hand by two men, however, a larger trawl net would require some kind of mechanical device to haul it on deck. When the cod end is on board the fish may be taken out by releasing the buoy line and allowing the after end of the cod end to open. The trawl net and doors are then to be made ready for another set and the whole operation repeated.